

Claims

1. A method for direct transmission of user data related to a call involving a first terminal device (10, 40) attached to a first access network and a second terminal device (12, 42) attached to a second access network comprising the steps of
 - establishing (S12, S46) a first transmission path (36, 62) for said user data, said first transmission path comprising
 - said first access network
 - a first core network communicating with said first access network,
 - a second core network communicating with said first core network, and
 - said second access network communicating with said second core network,
 - switching (S22, S24; S56, S58) from said first transmission (36, 62) path to a second transmission path (36', 62') for said user data, said second transmission path comprising a direct connection between said first access network and said second access network.
2. A method according to claim 1, wherein, before said step (S12, S46) of establishing said first transmission path for said user data, a step of establishing a third transmission path (34, 60) for control data related to said call is performed.
3. A method according to claim 2, wherein said third transmission path (34, 60) comprises the same networks as said first transmission path (36, 62) for user data.
4. A method according to claim 2 or 3, wherein said third transmission (34, 60) path remains unchanged before and after said step (S22, S24; S56, S58) of switching from said first transmission path (36, 62) to said second transmission path (36', 62').
5. A method according to any one of the preceding claims, wherein said first (36, 62), second (36', 62'), and third (34, 60) transmission paths involve a

first access-network element (14, 44) in said first access network, and a second access-network element (32, 58) in said second access-network.

- 5 6. A method according to any one of claims 2 to 4 comprising, before said step (S22, S24; S56, S58) of switching from said first transmission path to said second transmission path for said user data, a step (S16-S20; S50-S54) of performing a handshake between said first (14, 44) and second (32, 58) access-network elements.
- 10 7. A method according to any one of the preceding claims, comprising, before said switching step (S22, S24), a step (S14, S50) of providing first control information to at least a first access-network element (14, 32; 44, 58) involved in said first transmission path (36, 62) in said first access network and/or to at least a second access-network element (14, 32; 44, 58) involved in said first transmission path in said second access network, said first control information indicating that said direct transmission of user data
15 between said first and second access networks is possible.
- 20 8. A method according to any one of the preceding claims, wherein said step (S14, S50) of providing first control information comprises a step (S50) of transferring said first control information from said first access-network element (14, 44) to said second access-network element (32, 58).
- 25 9. A method according to any one of the preceding claims, wherein said step (S14, S50) of providing first control information comprises a step (S14) of transferring said first control information from a first core-network element (20) to said first access-network element (14).
- 30 10. A method according to claim 8 or 9, wherein said step (S14, S50) of providing first control information comprises a step a transferring said first control information from a second core-network element (26) in said second core network to said second access-network element (32).
11. A method according to claim 8, 9 or 10, wherein said first control information comprises a first information element indicating that in relation to said call said first or second access-network element (14, 32; 44, 58) has the role of an originating or a terminating access-network element, respectively.

12. A method according to any one of claims 8 to 11, wherein said step (S14, S16) of providing said first control information is performed during said step (S12) of establishing a third transmission path (34) for control data related to said call.
- 5 13. A method according to any one of the preceding claims, wherein said step (S14, S50) of providing first control information comprises a step (S16, S50) of transferring second control information from said first access-network (14, 44) element to said second access-network element (32, 58), or vice versa, said second control information containing a transport address of
10 said first (14, 44) or second access-network element (32, 58), respectively.
14. A method according to claim 13, comprising, before said step (S22, S24, S56, S58) of switching from said first transmission path (36, 62) to said second transmission path (36', 62') for said user data, a step (S18, S52) of responding to said second control information by transferring third control
15 information from the access-network element receiving (32, 58) said second control information to the access-network sending (14, 44) said second control information, said third control information containing a transport address of the respective access-network element having received said second control information.
- 20 15. A method according to any one of the preceding claims, comprising, after said step (S22, S24; S56, S58) of switching from said first transmission path (36, 62) to said second transmission path (36', 62') for said user data, a step (S28, S60) of transferring fourth control information from said first access-network element (14, 44) to said first core-network element (20, 50)
25 and/or (S26, S62) from said second access-network element (32, 58) to said second core-network element (26, 52), said fourth control information indicating that said step of switching from said first transmission path (36, 62) to said second transmission path (36', 62') for said user data related to said call has been performed successfully.
- 30 16. A method according to claim 15, comprising, after said step (S26, S28; S60, S62) of transferring said fourth control information, a step (S64, S66) of

saving said fourth control information for later use by said first and/or second core-network element (20, 26), respectively.

- 5 17. A method according to claim 15 or 16, comprising, after said step (S26, S28) of transferring said fourth control information, a step (S30) of forwarding said fourth control information from said first and/or second core-network element to further core-network elements in the first and/or second core-network, respectively, that are involved in said first transmission path (36, 62).
- 10 18. A method according to any one of the preceding claims, wherein, after said step of switching from said first transmission path (36, 62) to said second transmission path (36', 62') for said user data related to said call, a step (S32-S40) of switching back to said first transmission path for user data is performed under predetermined conditions.
- 15 19. A method according to claim 18, comprising, before said step (S32-S40) of switching back to said first transmission path, a step (S34) of transferring fifth control information from said first core-network element (20, 50) and/or said second core-network element (26, 52) to said first access-network element (14, 44) and/or said second access-network element (32, 58), respectively, said fifth control information indicating a request to switch back
- 20 the transmission path for user data to said first transmission path (36, 62).
20. A method according to claim 18 or 19, comprising, before said step of switching back from said second transmission path (36', 62') to said first transmission path (36, 62) for said user data, a step (S36, S38) of performing a handshake between said first and second access-network elements.
- 25 21. A method according to any one of the claims 18 to 20, comprising, before said step of switching back to said first transmission path, a step (S36) of transferring sixth control information from the access-network element receiving (32, 58) said fifth control information to the other access-network element (14, 44) involved in said second transmission path (36', 62'), said
- 30 sixth control information indicating a request to switch back the transmission path of user data to said first transmission path (36, 62).

22. A method according to claim 21, comprising, before said step of switching back to said first transmission path, a step (S38) of transferring seventh control information from the access-network element receiving (14, 44) said sixth control information to the access-network element sending (32, 58) said sixth control information, said seventh control information indicating acknowledging the coming switch back of the transmission path of user data to said first transmission path (36, 62).
23. A method according to any one of claims 18 to 22, comprising, after said step of switching back to said first transmission path, a step (S40, S42) of transferring eighth control information from said first (14, 44) and/or second (32, 58) access-network element to said first (20, 50) and/or second (26, 52) core network element, said eighth control information indicating that said step of switching back to said first transmission path has been performed successfully.
24. A method according to any one of the preceding claims, comprising, before said step (S22, S24; S56, S58) of switching from said first transmission path (36, 62) to said second transmission path (36', 62') for said user data, a step of transferring ninth control information from said first and/or second access-network elements to said first and/or second core-network elements, respectively, said ninth control information indicating that switching to said second transmission path is intended.
25. A method according to claim 24, comprising, before said step (S22, S24; S56, S58) of switching from said first transmission (36, 62) path to said second transmission path (36', 62') for said user data, a step of transferring tenth control information from said first or second core-network elements to said first and/or second access-network elements, respectively, said tenth control information indicating authorization to switch to said second transmission path.
26. A method according to any one of the preceding claims, wherein said call is of a circuit-switched connection type.

27. A method according to claim 26, wherein said step (S12) of establishing said third transmission path for control data comprises a step of negotiating a mechanism of coding and decoding of user data between the networks.
- 5 28. A method according to claim 26 or 27, wherein said step (S14, S16) of transferring said first and/or said second control information from said first access-network (14) element to said second access-network element (32) is performed using said third transmission path (34).
29. A method according to any one of claims 1 to 25, wherein said call is of a packet-switched connection type.
- 10 30. A method according to claim 29, wherein said step (S50) of transferring said first control information from said first access-network element (44) to said second access-network element (58) is performed using said first transmission path (62) for user data.
- 15 31. A method according to claim 30, wherein said first control information is contained in a first data packet transferred between said first (44) and second access-network elements (58) after said step of establishing said first transmission path (62).
- 20 32. A method according to claim 30 or 31, wherein said first and/or second control information is contained in at least one extension header of said first data packet, and said second control information comprises said transport address of the access-network element sending said first data packet.
- 25 33. A method according to any one of the claims 29 to 32, wherein said step (S50) of transferring said second control information from said first access-network element (44) to said second access-network element (58) comprises a step of forwarding said second control information from said first core-network element (50) to said second core-network element (52) in a second data packet.
- 30 34. A method according to any one of the claims 29 to 33, wherein said step of forwarding said control information from said first core-network element (50) to said second core-network element (52) comprises a step of copying said extension header to said second data packet.

35. A method according to any one of claims 29 to 34, wherein said step (S52) of responding to said second control information comprises a step of transferring said third control information in a third data packet from the access-network element receiving said second control information to the access-network element sending said second control information.
36. A method according to claim 35, wherein said third control information is contained in at least one extension header of said first data packet, and said third control information comprises said transport address of the access-network element receiving said first data packet.
37. A method for redirection of a direct transmission path for user data related to a call involving a first terminal device (10, 40) attached to a first access network and a second terminal device (12, 42) attached to a second access network,
- said direct transmission path for user data comprising before said redirection a first access-network element (14, 44) in said first access network directly communicating with a second access-network element (32, 54) in said second access network
 - said direct transmission path for user data comprising after said redirection said first access-network element (14, 44) in said first access network directly communicating with a third access-network element (64) in said second access network
- said method comprising
- a step (S74-S84) of establishing a first transmission path segment for user data between said first access network element (14, 44) and said third access-network element (64), and
 - a step (S86-S90) of releasing a second transmission path segment for user data between said first access-network element (14, 44) and said second access-network element (32, 54).
38. A method according to claim 37, wherein said step of establishing a first transmission path segment for user data comprises a step (S74-S76) of performing a handshake between said first access network element (14, 44) and said third access-network element (64).

39. A method according to claim 37 or 38, wherein before said step of performing a handshake a step (S70-S72) of providing said third access-network element with eleventh control information is performed, said eleventh control information indicating that said redirection is requested.
- 5 40. A method according to claim 39 wherein said step of providing eleventh control information comprises a step (S72) of transmitting said eleventh control information from a fourth access-network element in said second access-network to said third access-network element.
- 10 41. A method according to claim 40, wherein said eleventh control information contains a second information element indicating that said first transmission path segment is part of a direct transmission path.
42. A method according to claim 40 or 41, wherein said eleventh control information contains a transport address of said first access-network element (14, 44).
- 15 43. A method according to claim 40 or 41, wherein said step (S70-S72) of providing said third access-network element with eleventh control information comprises a step (S70) of transmitting twelfth control information from said second access-network element to said fourth access-network element, said twelfth control information indicating that said redirection is required by
- 20 said second access-network element.
44. A method according to claim 41 and 42, wherein said second information element and/or said transport address is transmitted from said second access-network element to said third access-network element with said eleventh and twelfth control information using a transparent container.
- 25 45. A first network element for controlling the operation of at least one transceiver station in a first access network in relation to a call between a first network terminal (10, 40) attached to said first access network and a second network terminal (12, 42) attached to said first access network or to a second access network, comprising
- 30 at least one first interface adapted to exchange control information and user data with said transceiver station,

at least one second interface adapted to exchange control information and user data with a first core-network,

a first call control unit connected to said first interface, and adapted to establish, maintain and release across said first interface in relation to said call a first control-channel section for transmission of control information and a first user-channel section for transmission of user data, said first control- and user-channel sections having as endpoints said network element and said transceiver station,

a second call control unit communicating with said first call control unit and connected to said second interface, adapted to establish, maintain and release across said second interface in relation to said call a second control-channel section for transmission of control information and a second user-channel section for transmission of user data, said second control- and user-channel sections having as endpoints said first network element and a predetermined core-network element in said first core-network, wherein said first call control unit is additionally adapted to establish, maintain and release across said first interface a third user channel-section for user data related to said call having as endpoints said first network element and a second network element in said first or second access network, respectively.

46. A network element according to claim 45 that is adapted to releasing said second user-channel section after said third user channel section is established.

47. A network element according to claim 45 or 46, that is adapted to assess whether an ongoing call is eligible for establishing said third user channel section.

48. A network element according to any one of claims 45 to 47, additionally adapted to perform method steps according to any of the claims 1 to 35.

49. Network system comprising a network element according to any one of claims 45 to 49.